THE FREIGHT CARBON ZERO GUIDE TO BATTERY ELECTRIC TRUCK IMPLEMENTATION

In partnership with
Volvo Trucks

WELCOME

Welcome to the *Freight Carbon Zero* guide to battery electric truck implementation. As the commercial vehicle and road freight sector commences its decarbonisation journey, we recognise fleet buyers and operators are faced with a broad range of new challenges as the fleet shifts from diesel to new alternative solutions.

Special thanks to Volvo Trucks UK & Ireland for its support in producing this guide. It's clear battery electric trucks are going to play an important role in the new vehicle choices of the future and in this guide we explore the key issues, demystify the challenges and explain the key steps required in preparing your operation for a carbon zero future.

We hope you like it.

Keep it clean…

Andy Salter
Editor, Freight Carbon Zero

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Photo: Craig Eccleston

Photo: Craig Eccleston

FREIGHT CARBON ZERO

Freight Carbon Zero is our web resource, dedicated to bringing you all the information about the industry's journey to a net zero future.
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CONTACT INFORMATION

Editorial
Contributor Louise Cole

Art and production
Group production manager Isabel Burton
Deputy group production manager Sean Behan

Display advertising
Sales director Emma Rowland

Directors
Divisional director Vic Bunby
Managing director Andy Salter

Printed by Warners Midlands
Distributed by Marketforce

Main office
DVV Media International, First Floor, Chancery House, St Nicholas Way, Sutton, Surrey SM1 1JB

TO BEV OR NOT TO BEV?

ELECTRIC VEHICLES: **IMPLEMENTATION**

If embarking on the transition to an electric fleet seems overwhelming, Volvo has good news. Start small, start easy – and let the Volvo team do the heavy lifting

WORDS: LOUISE COLE

The most important question for operators to answer is why they want to deploy an electric vehicle, says Volvo's e-mobility sales development manager Richard Riley

"There are typically two starting points. One is to fit an electric vehicle into an existing route, contract or application by customer request," he says. "The alternate goal, which gives an operator more flexibility, is to lower their overall carbon footprint by seeing where in their operation electric vehicles could be substituted for internal combustion engined (ICE) vehicles with relative ease."

There are strong governance reasons to embrace electric vehicles, given that they have no tail-pipe emissions, and have a lower dependency on fossil fuels depending upon the electricity feedstock. The electric motor also has 90% energy efficiency compared with typically 40% efficiency of a diesel engine. This makes their overall carbon footprint much lower, and if fleets commit to green energy or microgeneration that lowers their footprint even further.

Riley says: "We do not have cost parity between heavy ICE and battery electric trucks, so no one currently does this to save money.

Photo: Craig Eccleston

Counting the cost: The purchase price of a BEV is more than double that of an ICE vehicle, although TCO is considerably closer

However, there are very good reasons for operators to go electric with some vehicles, and these also represent potentially powerful commercial opportunities. Often the motivation for this is carbon reduction commitments made across the wider business or the securing of new business."

Battery electric vehicles (BEVs) are approximately two and a half times the cost of ICE vehicles in terms of purchase price, with total cost of ownership (TCO) being considerably closer. Most of the manufacturing cost is the battery, and battery methodologies and economies of scale are still developing.

It is difficult to map electricity costs against diesel as both are price volatile, especially over the past two years. Some of the benefits of a BEV, such as zero congestion or clean air zone charges, may disappear in the medium term and road charging will eventually replace falling fuel duty revenues, as a critical mass is reached in the overall vehicle parc. Therefore standard TCO models do not really apply.

However, Riley says that Volvo is now offering shorter contracts more in line with regular diesel terms on its leases, with typical contract lengths on rigids around six years and five years for tractors, rather than the very extended first life offerings the market had anticipated. This is because Scandinavian countries, in particular, are generating large amounts of real-world data, including residual values, and so Volvo can recalibrate its offering based on an ever-expanding knowledge base.

NEED TO KNOW

Electric motors offer 90% energy efficiency, compared with 40% for a diesel engine

INDUSTRY SNAPSHOT

"Decarbonisation is presented as daunting, difficult and complex. However, we've spent 12 months training the Volvo sales team to make it simple"

INDUSTRY SNAPSHOT

CARBON-CUTTING CUSTOMERS

In 2020, businesses accounted for 18% of all UK greenhouse gas emissions. Large companies are obliged to report on their carbon usage and plans for reduction through the SECR

regulations, including direct and third-party transport emissions.

Meanwhile, the UK government has urged all SMEs to try to halve their carbon output by 2030. Many companies are aiming to meet this target to satisfy customer demand and their own environmental goals.

So, says Riley, there is a huge opportunity for fleet operators to engage with their clients to explore how their transport operation can support freight customers' desire and need to cut emissions.

For example, decarbonising its transport usage is often the quickest and easiest win for a manufacturing business, not least because fleet replacement cycles are much faster than those of manufacturing plant.

In addition, of course, ICE HGVs up to 26 tonnes will cease being sold in 2035 and all new ICE HGVs in 2040. Fleets cannot afford to wait until those deadlines to start transitioning from ICE to electric – to do so would be unimaginable in terms of cost, the enormity of the change process and the huge demand for electric vehicles as the deadline closes in.

> **Sticking to simple processes and first principles will benefit operators**
>
> Richard Riley
> e-mobility sales development manager, Volvo

Photo: Paul Sherwood

Fleets would also lose a valuable opportunity to learn and adapt, while acting now gives them the status of early adopters and all the accumulated expertise that brings.

WHERE TO START

Riley says that many people in the logistics space try to overcomplicate the start of the fleet transition.

"This is new for all of us, so sticking to simple processes and first principles will benefit operators," he says. "At Volvo we will do all the heavy lifting for fleets in terms of identifying the vehicles which will be suitable for transition now."

Volvo is confident that its product can handle a significant percentage of logistics tasks even at maximum weights. "We ask operators to identify vehicles at different weight thresholds doing maximum journey lengths. These are purely indicative figures to filter out those worthy of further examination – for instance 2- or 3-axle rigids doing less than 250km, and 8-wheelers and artics which do 300km or less. That's a good basic filter which makes it very easy to know which trucks or routes to pass to us for further analysis," says Riley.

Volvo then asks for the routes, GVW, payload, stops, body/trailer dimensions and any ancillary equipment. Riley says there are multiple ways for operators to capture journey data, including postcodes, latitude and longitude, or downloading the Volvo Data Recorder onto drivers' phones.

The Volvo team will then run all the relevant fleet data through its analysis tool and produce a list of which vehicles could be swapped for electric counterparts. "We apply a buffer distance that seems appropriate to the client. For instance, for one operator involved in 'just in time' automotive delivery, trucks travelled a 15km round trip, hence we worked on a 25km buffer. For a 40-tonne truck doing 225km, we might have a buffer of 40km. The devil is in the detail, which is part of the discussions," he says.

The buffer alleviates any range anxiety while still ensuring that the vehicle can perform in an optimised way.

"Decarbonisation is presented as daunting, difficult and complex," says Riley. "However, we've spent 12 months training the Volvo sales team to make it simple. Simple criteria for operators, let our software analyse your journeys, and then simple decisions as to which vehicles would be suitable for transition right now.

"If nothing else, that is powerful information to have," he says. "We want to inspire and empower operators to begin this journey, and you do that by

identifying the easy wins – the greatest benefit for the least effort, risk or cost. That's our job.

"Our scenario modelling is powerful but for an operator it is very easy. Distil it down to distance by model, and we can then examine the most likely candidates for transition more closely," he adds.

IT'S GOOD TO TALK

Riley says that he has been engaging not only with operators but with their customers, and sometimes with the Volvo Innovation Lab team as well. "These multi-party discussions are really useful. They allow us to explain concepts and capabilities to freight owners, support our customers in these discussions and also to suggest workable solutions which meet everyone's needs in the most cost-effective way. I think I have spent more time talking to freight owners in the past 18 months than ever before in my career.

"The important thing for operators to understand is that starting with one or two electric vehicles is highly achievable and doesn't have to entail the enormous costs of connection upgrades etc," he says. "It is usually entirely feasible to start small and give yourself time to develop operational best practice with one vehicle and also be able to strategically plan future fleet transitions, without overcomplicating or extending your investment beyond the truck itself."

He says the entire logistics sector, the OEMs and the charging industry are at the beginning of a journey of discovery. "We are leaders in this field and we have [at the time of writing] 51 electric trucks [LC1] on the road in the UK & Ireland. Very few design specialists or charging suppliers have completed large-scale truck charging because it is in its infancy. So it makes sense for operators to take small steps, collaborate with stakeholders with minimal risk, and still gain the environmental and ESG benefits of having a decarbonised vehicle." □

HOW DOES A BEV WORK?

Battery electric vehicles (BEVs) use electric motors and motor controllers instead of ICEs for propulsion. They derive all power from battery packs and thus have no internal combustion engine, fuel cell or fuel tank. The battery stores electrical energy which is released to power any movement, heating, lights or ancillary equipment such as fridges, tail-lifts or moving floors.

The traction is generated through AC power. However, charging can be AC, which is slower, or DC, which is more rapid.

BEVs typically have 90% fewer moving parts than ICE vehicles. Common components include: a motor or engine; an inverter, which transforms DC current to AC; a drivetrain transmission, which sends power to the wheels; and a battery, which stores the power. The higher the kW capacity of the battery the more work the vehicle can do. Work in this sense is defined as range, but it is really a combination of weight and distance.

BEVs produce no tailpipe emissions and so are counted as green for air-quality purposes. However, the source of the electricity is an important factor of the true carbon footprint. Typically about 40%of the UK's electricity is from renewable energy, but this varies depending on how much sun and wind we get in a given year. Another 15.5% is from nuclear energy.

Keep it simple: BEVs have far fewer moving parts than ICE vehicles, with common components including a motor or engine, an inverter, a drivetrain transmission and a battery

Photo: Nigel Spreadbury

GATEWAYS TO POWER

ELECTRIC VEHICLES: **INFRASTRUCTURE**

Most fleets think going electric means huge infrastructural investment. But it is usually possible to start going green without huge overheads, says Volvo

WORDS: **LOUISE COLE**

Logistics operators are constantly being told that infrastructure is the most immediate and expensive barrier to running electric vehicles (EVs). Wrong, says Volvo Trucks' e-mobility sales development manager Richard Riley. Fleets should start small and work with what they've got.

"There is a lot of learning to be done about running electric trucks in the UK and Ireland, and it makes no sense for operators to be sold the most complex and expensive solution right at the start of this journey," he says. "Most operators could run an electric truck with the energy output they currently have with nothing more expensive or complex than an AC box on the wall, which Volvo supplies with every vehicle."

Large-scale charging installations have so far mostly been carried out in public spaces for cars, and for back-to-base bus operations, neither of which have the same profile as an HGV operation.

Photo: Craig Eccleston

AC or DC: Operators can often keep costs down by charging with an AC outlet at first, rather than investing in more expensive DC charging

STARTING SMALL

"Providing future-proofed charging for large numbers of HGVs is a much more specialist operation and the number of vehicles on the road means it is rarely justified at this stage," says Riley. "We advise operators to start by letting us identify the appropriate vehicles for transition, and then exploring how far they can go with AC before planning future investment. If you can charge with relatively low power output initially, it allows you to avoid larger capital outlay."

A 63A three-phase AC outlet costs about £5,000. In most cases this could support overnight charging for one or two trucks running 70,000km a year or 250km a day for 275 days of the year. Volvo can provide the AC box along with the vehicle.

If, for example, the vehicles are running 90,000km a year and so need charging more rapidly, the next step up is a DC outlet. DC charging is faster, and typically more expensive, as the conversion from AC to DC (which is what the vehicle uses) happens in the unit and not onboard the vehicle itself.

"Our normal sales process now looks at the suitability of trucks for electrification, and what relatively low-cost charging options would be workable," says Riley. This phased start is essential for operators to learn exactly how EVs fit into

their operation, the optimal times for charging and whether duty cycles need to be amended. "We are seeing customers take vehicles with low-cost charging solutions and gradually gain in experience and confidence."

CALCULATING CAPACITY

The next stage is for operators to engage an energy infrastructure specialist, who can measure the electricity headroom the site has, as well as help to formulate plans for the future. Volvo works with affiliated companies who can support operators in formulating the best short-, medium- and long-term plans.

If the site does not have sufficient power coming in to support an operator's plans, an energy specialist can calculate the power available compared to what the operation will require for the EVs and duty cycles they have planned.

Energy infrastructure specialists can also advise operators on how to reduce that energy deficit with other measures – such as battery storage solutions that capture available energy at times of low demand – and feed it back into the site when needed.

Volvo will implement this at two of its dealer locations. Riley says the company will continue to finesse this solution to better understand how charging sites can use batteries to good effect. It is both a portable solution, should the dealers relocate, and one which can easily be upgraded to improve efficiency or capacity.

UPS has recently bypassed the need for a network upgrade at its Kentish Town site by working with UK Power Services to create a 'smart grid', which it says is a 'game-changer' for logistics decarbonisation. This allowed UPS to increase its electric fleet from 65 vehicles to 170 without upgrading its network connection.

The 'smart grid' comprises an Active Network Management system that monitors the maximum demand required by the site and controls and schedules vehicle charging. It is supplemented by an energy storage system, capable of receiving or discharging energy depending on tariffs, demand and vehicle requirements.

NEED TO KNOW

Use of a 'smart grid' allowed UPS to increase its electric fleet from 65 vehicles to 170 without upgrading its network connection

Photo: Craig Eccleston

INDUSTRY SNAPSHOT

"It is worth speaking with your DNO directly, in order to understand the limitations and costs involved with your site"

INDUSTRY SNAPSHOT

These lower-cost or managed solutions can be particularly useful for companies that would face high connection upgrade charges, or that rent their premises.

Currently the cost for infrastructure improvements on a leased site is a matter of negotiation with landlords. Network upgrades and charge points enhance the value of the

site but, given that many property owners are already facing substantial bills for improving the environmental efficiency of buildings, some are reluctant to share potential energy upgrade costs.

CONNECTION UPGRADE COSTS

The UK's electricity network is undergoing upgrades because National Grid is aware that energy demands will increase by 50% over the next decade.

At some future point many sites will require a distribution network operator (DNO) connection upgrade, allowing them to pull down more power from the grid than would normally be available. The rules on network connection costs have recently changed. From 1 April, customers making demand connection applications will pay for extension assets only – that means cables, tower, poles etc, which only serve your site. Network reinforcement costs are fully funded by the DNO.

High-cost project thresholds apply, to limit the exposure of bill payers to excessively high costs.

Unfortunately the cost of any specific development is variable by location, depending upon the groundworks necessary; the current available supply, capacity and length of cabling; and third-party costs such as local authority charges for road closures.

> **"Most operators could run an electric truck with the energy output they currently have"**
>
> **Richard Riley**
> **e-mobility sales development manager, Volvo**

Some locations are therefore much more costly than others. This means that for operators eventually wanting EV-ready depots across the UK, it is worth doing some initial exploration of the potential differences in fees at all of the proposed sites. Early exploration of regional costs also means your business plan is less likely to be exploded halfway through than if you assume that all site works will have similar price tags.

HOW DO THEY CHARGE?

The DNOs follow a common methodology to calculate connection charges and this is approved by Ofgem. The DNOs are bound by statutory and licence obligations to ensure they offer the lowest overall capital cost to provide the connection.

They are allowed to recover the reasonable costs incurred, both direct and indirect, in providing a connection and may, where allowed by their licence, apply a margin on some of those costs. The limits of costs recovered and margins are set by Ofgem in the ED2 price controls, which run until 2028.

The DNOs each publish a connection charging statement, which details the unit costs for equipment and construction services. Quotes should provide a breakdown of the connection charge, cross-referrable to the connection charging statement. They will also detail non-contestable and contestable costs – this helps fleets to know what items they might get a better price on with an independent connections provider, or through negotiation.

Photo: Shutterstock / Neil Mitchell

Upgrading the infrastructure: National Grid is planning for a 50% increase in demand for energy

The Energy Networks Association (ENA) says that DNOs can offer a range of options for calculating costs, from initial budget estimates through to more detailed feasibility studies, in advance of a formal quotation. DNOs also offer connections surgeries for new connection applications. The ENA encourages all potential applicants to contact their DNO as early as possible.

CHOOSE THE RIGHT SUPPLIER

Choose your electrical engineering specialist carefully. This is a relatively new field for everyone, but there is existing expertise within the companies that have worked in the bus sector. Volvo can put operators in touch with prospective suppliers.

It is also worth speaking with your DNO directly, in order to understand the limitations and costs involved with your site.

The UK energy market has layers of responsibility. The National Grid does exactly what its name implies. Its regulated businesses in the UK operate the high voltage electricity transmission (ET) network in England and Wales. National Grid Electricity System Operator (ESO) is the legally separate part of the group that manages supply and demand on Britain's electricity transmission networks. ESO is in the process of becoming fully independent.

NEED TO KNOW

DNOs can offer a range of options for calculating costs in advance of a formal quotation

Seek out advice: Transitioning to EVs can seem daunting but there are plenty of experts who can offer help and advice, including energy infrastructure specialists, the ENA, DNOs and electrical engineering specialists

Six DNO groups own and operate the infrastructure that connects homes and businesses to the national network:

- SP Energy Networks: central and Southern Scotland, north Wales, Merseyside, Cheshire and north Shropshire;
- Scottish and Southern Electricity Networks: central southern England and the north of Scotland;
- Northern Powergrid: North East of England, Yorkshire and northern Lincolnshire;
- Electricity North-West: North West of England, from Carlisle to Stockport;
- UK Power Networks: London, the South East and East of England;
- National Grid (formerly Western Power Networks): Midlands, South West of England and Wales.

There are also 14 independent DNOs. These own, operate and maintain newer parts of the electricity grid that supply housing and commercial developments and are directly or indirectly connected to the main distribution network. A list is available on the ENA website. □

THE TIME IS NOW

ELECTRIC VEHICLES: **APPLICATIONS**

Volvo says its electric trucks can now handle many operations carried out by internal combustion engined vehicles. We look at the options

WORDS: **LOUISE COLE**

The R&D put into electric vehicles (EVs) over the past five years has finally paid off with models that can manage almost all the standard duty cycles and applications involved in modern logistics, says Volvo Trucks' e-mobility business development director Richard Riley.

"We have a complete line-up of electric trucks up to 44 tonners, equipped for general haulage or specialist applications. And they all have sufficient range to do the job with assurance," he says.

Volvo's sales team has spent a year building EV awareness, toolsets and application profiles into the standard sales process, so they can identify the best vehicles for operators to start their electrification journeys with low-cost charging solutions.

NEED TO KNOW

Individual scenario testing will always give more accurate results than generalised figures

"Every operation is different but whether you are doing local authority work, construction work, general haulage or urban deliveries we have a model optimised for that application, and specialist analysis software which can identify the best vehicles with which to start your journey," he says.

Mark Collins, Volvo's e-mobility and body builder product manager, says: "Many factors make significant differences to range and efficiencies of EVs. As a result, in the absence of a real-life trial, we always urge operators to engage in an electric range simulation, provided by the Volvo sales team, using accurate data upfront for each individual case. This includes accurate body details, vehicle spec, operating times, and payload, as these can be the difference between a vehicle that completes its intended duty cycle and one that doesn't." He says that although Volvo's quoted ranges are based on robustly tested

data, individual scenario testing will always give more accurate results than generalised figures.

One advantage for operators is that the vehicles look and perform in a very similar way to the internal combustion engined (ICE) trucks they are familiar with. In some ways OEMs were robbed of the opportunity to innovate by the urgency of meeting EU-set CO_2 emission reduction targets in 2025 for N3 vehicles above 16 tonnes, including 4x2 and 6x2 rigids and tractors. However, from a fleet manager or driver's viewpoint, this does mean that the electric trucks appear as a mechanically simpler and quieter version of what they are used to.

"Broadly, if you can build the body on a diesel, you can build it on an EV," says Riley. "It's no longer a case of 'one day'. These vehicles are here, now, and we can start getting them onto the road."

80% of Volvo dealerships will be fully trained and equipped for EV trucks by the end of the year, with regions in which operators are running EVs having priority.

> **"Broadly, if you can build the body on a diesel, you can build it on an EV"**
>
> **Richard Riley e-mobility sales development manager, Volvo**

WARRANTIES AND SUPPORT

Volvo Trucks typically offers five-year leases for its tractors and six years on rigids. The batteries come with a minimum energy guarantee for the lifetime of the repair and maintenance contract.

> **INDUSTRY SNAPSHOT**
>
> **"If an operator does experience any battery degradation affecting performance we guarantee that we'll swap the affected modules, or the whole battery if necessary"**
>
> **INDUSTRY SNAPSHOT**

This means that, as well as covering material failure, if a battery pack experiences degradation that results in capacity dropping below 80% of the initial usable energy, Volvo will replace individual battery packs to restore at least 80% of the original capacity.

"All batteries degrade eventually through two processes – one is simply time. The other is charging cycles. We are confident that our batteries

VOLVO MODELS AND APPLICATIONS

This is not a comprehensive list but it gives an indication of the wide variety of applications already being met by electric trucks:

URBAN DELIVERY: FL ELECTRIC

The FL 4x2 16.7 tonne rigid offers up to 300km at maximum battery capacity under ideal conditions. For operators who need less range per shift, less capacity can support increased payload instead. Charging takes 11 hours AC or two hours DC.

VOLVO FL ELECTRIC	
Axle Configurations	Rigid: 4x2 All axles are air suspended
Cab	Day cab, short sleeper cab
Gross Combination Weight	Up to 16.7 tonnes
Battery capacity	280–565 kWh, 3 to 6 batteries
Range	Up to 300km
Charging time (full charge, 4 battery packs)	16.8hr with AC (22kW) 2.3hr with DC (150kW)
Driveline	Single electric motor, 2-speed gearbox
Performance	Up to 130kW (175hp) continuous power
Applications	Suitability for bodywork. Electric PTO

WASTE/LIGHT CONSTRUCTION: FE ELECTRIC

The FE Electric is a 3-axle truck with a gross vehicle weight up to 27 tonnes. It is designed for demanding urban transport like waste collection, light construction and deliveries. Available as a 4x2 or 6x2 rigid, it offers up to 120km for light construction or waste and 200km for distribution.

PRIMARY DISTRIBUTION/TRUNKING: FH ELECTRIC

Volvo dubs its FH Electric the "heavy metal" truck because, it says, it rocks. It's been driven 345km on one charge at 40 tonnes. If topped up during breaks, it could reach up to 500km in one day's shift. With up to 490kW continuous and instant power, this is the vehicle for trunking or intra-city journeys. Available configurations include 4x2 and 6x2 tractors at 40, 42 and 44 tonnes. It takes 10 hours to charge AC or less than two hours DC.

INTRA-CITY OR EQUIPMENT HANDLING: FM ELECTRIC

The FM Electric can perform high-capacity grocery deliveries, crane services and more in urban areas. Like all the electric trucks, its silent running makes it a strong contender for out-of-hours and night-time deliveries.

will perform with minimal loss throughout the lease cycle, and we have Volvo Energy, a specialist division which is responsible for battery management and maintenance," says Riley.

"If an operator does experience any battery degradation affecting performance we guarantee that we'll swap the affected modules, or the whole battery if necessary," he says.

THE MISSING LINK

Although the line-up of electric trucks is impressive for more generalised applications, there are some specific exceptions in more specialist areas where electric drivetrains don't yet work. Muckaway and off-road models are not catered for, as the battery placement on EVs – underneath the chassis between the first and second axles – is not ideal.

High-power concrete pumps, fire engines and sweepers are also a challenge, because the power and packaging requirements do not work with current designs.

Only short tipper and tanker configurations are provided for 6x2 tractors. The fifth wheel on 6x2 tractors needs to be pushed rearwards to

Photo: Nigel Spreadbury

Delivering the goods: Tesco recently took on a 40-tonne FM Electric, which is transporting groceries to its stores across Greater London, Suffolk, Essex and Kent

The FM recently became the first 40-tonne zero-emission truck to be delivered into a UK supermarket, joining Tesco to deliver goods to stores across Greater London, Suffolk, Essex and Kent, hauling ambient grocery items seven days a week.

A 6x2 44-tonne model is hauling up to 24 tonnes of whisky on a triaxle boxvan for Scottish distillery Chivas Brothers, with a range of up to 250km.

Two FM Electrics have also gone into Nationwide Platforms' Birmingham and Warrington depots to pull step-frame trailers transporting hire equipment to and from sites around Birmingham and the North West. The company says it needs sufficient power for 150km a day plus running ancillary equipment.

Photo: Craig Eccleston

VOLVO FM ELECTRIC

Axle Configurations	Tractor: 4x2, 6x2 Rigid: 4x2, 6x2, 6x4, 8x2 Tridem, 8x4 Tridem All axles are air suspended
Cab	All cab lengths
Gross Combination Weight	Up to 44 tonnes
Load capacity	23 tonnes
Battery capacity	450-540kWh
Range	Up to 300km
Charging time (full charge)	9.5hr with AC (43kW) 2.5hr with DC (250kW)
Driveline	3 electrical motors, I-Shift gearbox, 2 power levels (up to 650hp)
Performance	Up to 2,400Nm and 490kW (650hp)
Applications	Suitability for bodywork. 3 PTOs (electrical, mechanical and gearbox)

ensure landing leg and chassis clearance, which makes the rig overlength when coupled to a full-length ISO trailer and also means it can't meet the legal turning-circle requirements.

THE ROLE OF CREATIVITY AND COLLABORATION

Electric trucks may look much the same as their ICE counterparts and they may do the same job. However, that doesn't mean that the industry does not have an opportunity to innovate to improve the efficiency and carbon footprint of operations. There are still challenges ahead in terms of electrifying fleets, not least the lack of a public charging infrastructure for electric trucks. Some operators suggest this means the business case for multi-leg tramping will disappear because all work will require back-to-base operations.

However, challenges like this could also open up possibilities for interoperational collaboration. Hauliers already offer secure parking spaces to one another through the Transport Association or SNAP; perhaps the future will see charging facilities shared as well.

NEED TO KNOW

Most electric trucks will be allowed an extra 2 tonnes across the board except for the heaviest vehicles and certain configurations

The high capital costs of EVs will also eventually change the business case for haulage, just as limitations on battery life will almost certainly alter the used-truck market.

The trucks may appear like for like, but electrification is still a possible disruptor which holds the potential for transformative changes in operations.

HEAVIER VEHICLE WEIGHTS

The UK government has recently confirmed that gross vehicle weight will increase to accommodate the extra weight contributed by batteries. The Road Vehicles (Authorised Weight) (Amendment) Regulations 2023 states that most electric trucks will be allowed an extra 2 tonnes across the board except for the heaviest vehicles, which remain at 44 tonnes, and certain configurations, such as 4-axle 32-tonne rigids. □

Smooth yet powerful: Scottish distillery Chivas Brothers has employed a 6x2 44-tonne FM Electric with a range of up to 250km

ELECTRIFYING EXPERIENCES

ELECTRIC VEHICLES: **PERFORMANCE**

Electric trucks may perform as well as internal combustion engined vehicles but how do you measure that? We look at the metrics and how they are affected by driver performance

WORDS: **LOUISE COLE**

The idea of swapping mpg for kilometres per kilowatt hour (km/kWh) isn't complex. It is the same principle of measuring how far applied fuel will allow a vehicle to travel at a given weight. Technically, one litre of diesel offers the same energy as approximately 10kWh, but diesel engines typically only have 40% efficiency, so 6kWh is lost. Electric motors have 90% efficiency, although there are always losses when transmitting energy, including from the grid, from AC-DC inversion and battery charge inefficiency. Overall, Volvo believes that electric vehicles (EVs) can offer 50% greater efficiency than their internal combustion engined (ICE) counterparts.

There are other efficiencies from EVs and, if industry works alongside local government and trade associations, these could be maximised. Out-of-hours deliveries are the most obvious benefit, with the near-silent motors allowing operations during quieter times, including at night-time. It remains to be seen whether the London Lorry Control Scheme will exempt electric vehicles, but it will certainly become more difficult to justify their exclusion from restricted routes at nights and weekends.

TELEMATICS

Volvo's own telematics system, Volvo Connect, will report on all the driver performance indicators that it provides in its ICE vehicles. Furthermore, the

Making a statement: Electrification can be an enticement to prospective customers who are looking to cut their reported carbon emissions

driver will get real-time information on battery life and remaining range at current speeds and weight.

Operators can also use the system to run route scenarios to see how the truck's range will be affected. Factors that affect range include:

- **Ambient temperature:** energy consumption goes up in colder temperatures, but is less affected by warmer temperatures. Volvo vehicles are approved up to 40°C. Drivers can also pre-condition the vehicle while it is still charging to bring the internal temperature up to an acceptable level. This takes the strain off the heater when the vehicle is in motion because it takes less energy to maintain a temperature than to raise it significantly.

Analysis of electric cars and vans by Geotab in San Diego showed that a 10°C drop in temperature had far more effect on vehicles moving slowly than those moving at highway speeds. The study suggested that vehicle range halved in some circumstances although Mark Collins, Volvo's e-mobility and body builder product manager, says this is not something Volvo has observed in its trucks.

In vans, Geotab found that the drag caused by faster speeds was far less than in cars, so vans had the best range at 20°C with the optimal speed at 20kph. At 0°C, the optimal speed was 40kph.

- **Payload:** For some operations this will be fairly constant, but on multidrop operations the effect of a decreasing payload throughout the route,

INDUSTRY SNAPSHOT

"Volvo believes that electric vehicles can offer 50% greater efficiency than their internal combustion engined counterparts"

INDUSTRY SNAPSHOT

NEED TO KNOW

Higher speeds drain batteries more quickly, as motor efficiency decreases and the air resistance is increased

or the effects and best order of collections, can be calculated. Here EV-enabled optimisation software is the transport manager's friend.

- **Gradients:** It's harder to go uphill than down, but the effect of gradients is an interesting example of the beauty of route optimisation. EV torque is unaffected by altitude, so good news for those driving through the Highlands or the Peak roads in the Pennines.
- **Speed variations:** The effects of regenerative braking mean that EVs have more range in city driving than on long stretches of motorway. That said, smooth driving will always be beneficial. Aggressive acceleration and harsh braking will still waste energy.
- **Motorways:** Tweaking speed limiters downward may be a good move here. Higher speeds drain batteries more quickly, as motor efficiency decreases and the air resistance is increased. Given that operators who limit trucks to slightly below the 56mph allowed on motorways see no significant difference in journey times, limiting eHGVs to between 50 and 53mph might be disproportionately beneficial in extending range. Using cruise control on the motorway is most efficient.

> "This is Knowles putting our money where our mouth is"
>
> Alex Knowles, managing director, Knowles Transport

- **Ancillary equipment:** Fridges, tail-lifts, air-conditioning, lights, wipers, hydraulics-operated bodies, moving floors, side loaders, compressors – anything which needs power is running off that main motor, including heating when parked.
- **Driver behaviour:** Volvo Trucks EVs all have a 'soft start', meaning drivers should not experience the so-called over-tapping effect that is causing insurers considerable pain with sports and luxury electric cars.

However, EVs have a linear maximum torque from the moment the motor is engaged, so it pays for the driver to be as light-footed as possible. Smooth acceleration and braking will achieve the best results, as well as being easier on the few moving parts an EV has – brakes and tyres.

A good tyre management policy will pay dividends. Optimal inflation, tread levels and tyre alignment will positively affect range.

MEASURING RETURN ON INVESTMENT

Standard total cost of ownership models are not particularly useful at the moment to calculate the whole-life cost of electric trucks. There are simply too many variables and too many

CASE STUDY: KNOWLES LOGISTICS

Knowles Logistics initially ran a three-week trial of the Volvo FE Electric to establish its viability as part of the fleet. Drivers responded positively, and the vehicle presented no range problems for collection and delivery routes.

Knowles acquired the 19-tonne 4x2, 23ft curtainsider with tail-lift. The FE Electric features twin electric motors producing 225kWh and 850Nm torque with a Volvo 2-speed gearbox and a 200km range.

To make the vehicle more operationally flexible, Knowles also invested in a 150kWh supercharger, which means that if necessary it can be charged in two hours and double shifted.

"This is Knowles putting our money where our mouth is," said Alex Knowles, managing director of Knowles Transport. "There are plenty out there marketing their sustainability credentials without backing it up with investment."

He says the vehicle makes the 'perfect urban platform' for Knowles, although it would be limited in any long-range application. With a short wheelbase of 5,500mm and "nimble handling", it also fits the accessibility criteria for urban construction and demolition work.

Knowles has been implementing a carbon reduction plan for some time, having invested in rainwater harvesting, solar panel electricity generation and electric forklifts. It is conducting a roof deflector aerodynamics trial, and it uses hydrotreated vegetable oil (HVO) in the ICE fleet. Earlier this year, it invested in a baseline CO_2 assessment from consultancy Davies and Robson to give baseline measurements of kg CO_2 equivalent (CO_2e) per mile for transport, kg CO_2e per pallet in for handling, and kg CO_2e per pallet week for storage, which allows them to keep customers informed of their third-party emissions footprint.

Knowles has gone on to place orders for three more FM Electric 4x2 tractor units.

uncertainties for any meaningful calculation, or indeed a useful comparison with diesel.

There are savings in terms of vehicle excise duty, congestion and some clean air zone charges – in particular the nascent zero emission zones – although such policies are always subject to change during the course of a lease. Electricity, especially if charging at night, still has the edge financially on diesel/Adblue costs.

There are also potentially many commercial benefits to being an early adopter of EVs. Large companies are bound to reduce their carbon output, which includes third-party transport emissions, and SMEs are being urged by government to halve their carbon output by 2030, with 2019 or later emissions data as the baseline.

Some logistics operations feature in one or other of these groups, and many others will work for companies who are. Electrification can be a powerful statement and an enticement to prospective customers who are looking to cut their reported carbon emissions, allowing operations to boost their own green credentials and add value for new and existing customers. □

INDUSTRY SNAPSHOT

"The effects of regenerative braking mean that electric vehicles have more range in city driving than on long stretches of motorway, but smooth driving will always be beneficial"

INDUSTRY SNAPSHOT

CASE STUDY: MCPHERSON LTD / CHIVAS BROTHERS

McPherson Ltd of Aberlour is managing an electric trial for Scottish whisky-maker Chivas Brothers. The 6x2 Volvo FM Electric tractor unit will pull a triaxle box van trailer, operating at up to 44 tonnes gross vehicle weight.

It's powered by three electrical motors, generating an output of 666hp and 2,400Nm of continuous torque and is capable of hauling approximately 24 tonnes of whisky per journey. Five batteries provide a range of up to 250km – Volvo says six batteries would give 300km in the right conditions.

The vehicle is charged at McPherson's depot, which is next door to Chivas's site in Kilmalid, on a 43kW charger.

Chivas will run the trial with McPherson for two years and both companies say they are enthused about the learning they can engender. Chivas has a target to halve its overall carbon emissions by 2030 and has already rolled out other sustainable transport solutions across its operations, including a fleet of six circular biogas trucks and 19 site-based shunt vehicles, approximately half of which are currently trialling HVO fuel. It says this truck will further reduce its output by 155 tonnes per annum.

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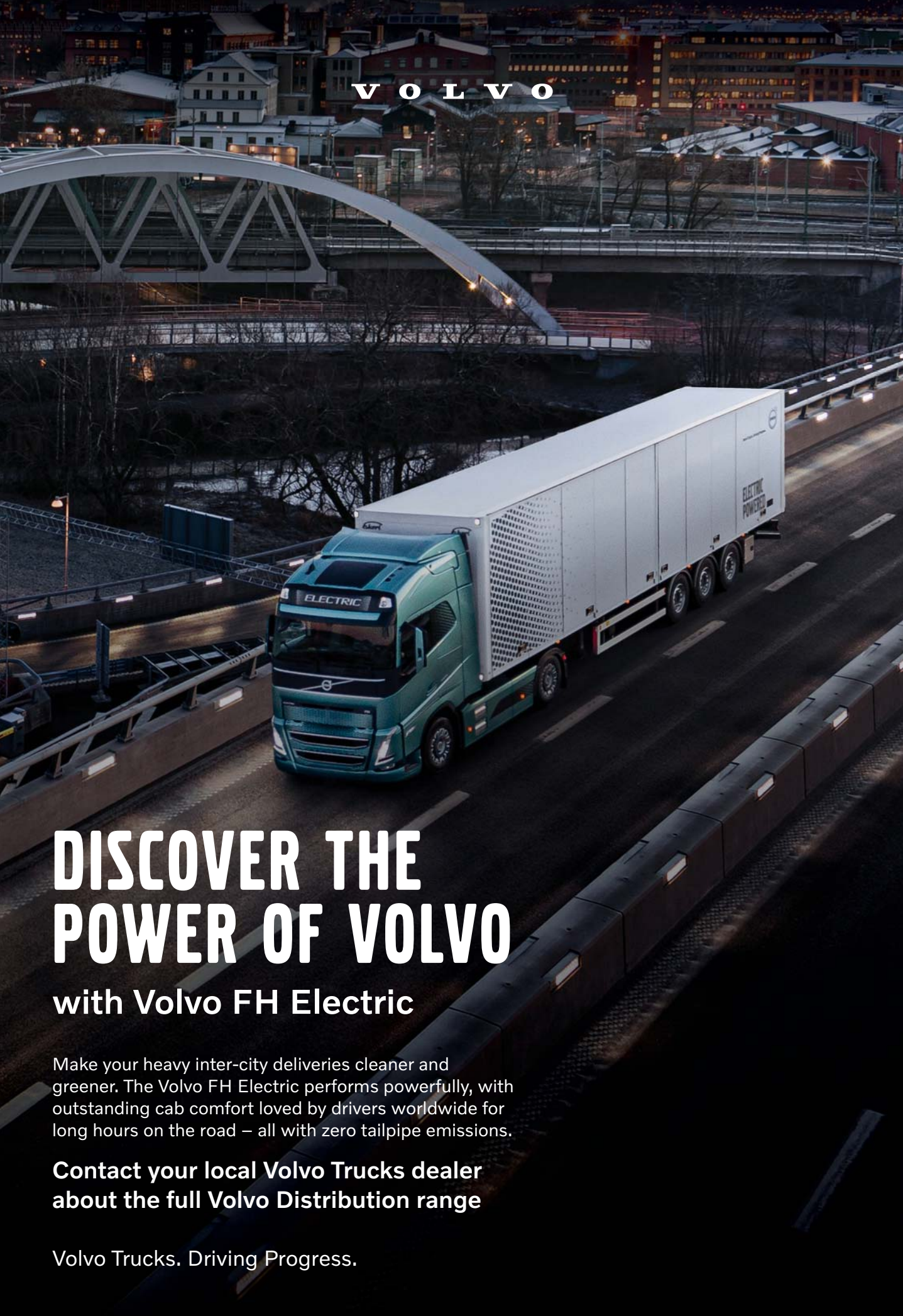

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